

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial No.:

Group Art Unit:

Inventors: Acharya et al.

Filed: Concurrently

Title: Cryocooler System With
Frequency Modulating
Mechanical Resonator

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

In accordance with 37 CFR 1.51, 1.56 and 1.97 to 1.99, the following is a relevance statement on each citation listed on attached form PTO-1449, and is made of record to assist the Patent & Trademark Office in its examination of this application:

U.S. 5,129,232 – Minas et al. discloses a system whereby the vibration loads produced by a cryocooler are isolated from a superconducting magnet and cryostat through the use of flexible laminated copper connectors and rubber mounts. There is no disclosure of a refrigeration generation system wherein a frequency modulating mechanical resonator is positioned between a pressure wave generator and a cryocooler for reducing the frequency of the oscillating gas emanating from the pressure wave generator, and thus this reference neither discloses nor suggests the claimed invention.

U.S. 5,363,077 – Herd et al. discloses a magnetic resonance imaging system having a cryocooler penetration assembly and a superconducting coil assembly wherein the weight of the cryocooler penetration assembly is supported independent of the superconducting coil assembly which, together with flexible

connections, isolates the vibrations of the cryocooler coldhead from the superconducting coil assembly. There is no disclosure of a refrigeration generation system wherein a frequency modulating mechanical resonator is positioned between a pressure wave generator and a cryocooler for reducing the frequency of the oscillating gas emanating from the pressure wave generator, and thus this reference neither discloses nor suggests the claimed invention.

U.S. 6,374,617 – Bonaquist et al. discloses a pulse tube system wherein a product fluid such as hydrogen is preferably precooled and then liquefied, subcooled and/or densified by heat exchange with ultra cold gas generated by a pulsing compression wave which rejects heat into a cryogen fluid heat sink. There is no disclosure of a refrigeration generation system wherein a frequency modulating mechanical resonator is positioned between a pressure wave generator and a cryocooler for reducing the frequency of the oscillating gas emanating from the pressure wave generator, and thus this reference neither discloses nor suggests the claimed invention.

U.S. 6,378,312 – Wang discloses a pulse tube cryorefrigerator having integrated reservoirs and housing for a rotary valve, valve plate and drive motor. There is no disclosure of a refrigeration generation system wherein a frequency modulating mechanical resonator is positioned between a pressure wave generator and a cryocooler for reducing the frequency of the oscillating gas emanating from the pressure wave generator, and thus this reference neither discloses nor suggests the claimed invention.

U.S. 6,578,364 – Corey discloses a mechanical resonator for a thermoacoustic device which includes a member for mimicking dynamic conditions at a position of the housing, and a linear suspension element suspending the member in the housing. There is no disclosure of a refrigeration generation system wherein a frequency modulating mechanical resonator is

positioned between a pressure wave generator and a cryocooler for reducing the frequency of the oscillating gas emanating from the pressure wave generator, and thus this reference neither discloses nor suggests the claimed invention.

U.S. 6,604,363 – Corey et al. discloses a method for matching an acoustic load and an acoustic driver in a resonant acoustic system, and the acoustic system so formed, comprising a matching volume positioned between the acoustic driver and load that is substantially greater than a stroke volume of the driver. There is no disclosure of a refrigeration generation system wherein a frequency modulating mechanical resonator is positioned between a pressure wave generator and a cryocooler for reducing the frequency of the oscillating gas emanating from the pressure wave generator, and thus this reference neither discloses nor suggests the claimed invention.

U.S. 6,640,553 – Kotsubo et al. discloses a pulse tube refrigeration system having a pulse generator, a regenerator and a pulse tube, comprising a tapered work transfer tube interposed between the pulse generator and the regenerator. There is no disclosure of a refrigeration generation system wherein a frequency modulating mechanical resonator is positioned between a pressure wave generator and a cryocooler for reducing the frequency of the oscillating gas emanating from the pressure wave generator, and thus this reference neither discloses nor suggests the claimed invention.

U.S. 6,644,038 – Acharya et al. discloses a pulse tube refrigeration system wherein the pulse tube working gas is cooled to a defined first stage temperature and is brought to a defined second stage temperature by operation of a regenerator and pulse tube, which are in flow communication through a cold heat exchanger, prior to providing refrigeration to a high temperature superconductor. There is no disclosure of a refrigeration generation system wherein a frequency modulating mechanical resonator is positioned between a pressure wave generator and a

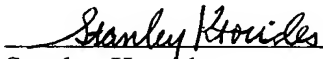
cryocooler for reducing the frequency of the oscillating gas emanating from the pressure wave generator, and thus this reference neither discloses nor suggests the claimed invention.

Pressure Wave Generator For A Pulse Tube Cooler, Matsubara et al.

describes the operation of a pressure wave generator for a pulse tube cooler wherein the pressure wave is generated at the resonance frequency of the resonator of the pulse tube cooler. There is no disclosure of a refrigeration generation system wherein a frequency modulating mechanical resonator is positioned between a pressure wave generator and a cryocooler for reducing the frequency of the oscillating gas emanating from the pressure wave generator, and thus this reference neither discloses nor suggests the claimed invention.

A copy of the non U.S. patent reference is attached.

Respectfully submitted,


Stanley Ktorides
Attorney for Applicants
Reg. No. 29,399

Praxair, Inc.
39 Old Ridgebury Road
Danbury, CT 06810-5113
Phone: (203) 837-2178

Attorney Ref.: D-21413

Date: MARCH 29, 2004

Form PTO-1449 (Rev. 8-83)		U.S. Department of Commerce						Atty. Docket No. D-21413				Serial No.					
Information Disclosure Citation (Use several sheets if necessary)										Applicants Acharya et al.							
										Filing Date				Group			
U.S. PATENT DOCUMENTS																	
Examiner Initial		Document Number							Date	Name	Class	Subclass	Filing Date if Appropriate				
		5	1	2	9	2	3	2	7/1992	Minas et al.	62	51.1					
		5	3	6	3	0	7	7	11/1994	Herd et al.	335	216					
		6	3	7	4	6	1	7	4/2002	Bonaquist et al.	62	6					
		6	3	7	8	3	1	2	4/2002	Wang	62	6					
		6	5	7	8	3	6	4	6/2003	Corey	62	6	4-20-01				
		6	6	0	4	3	6	3	8/2003	Corey et al.	62	6	4-20-01				
		6	6	4	0	5	5	3	11/2003	Kotsubo et al.	62	6	11-20-02				
		6	6	4	4	0	3	8	11/2003	Acharya et al.	62	6	11-22-02				
FOREIGN PATENT DOCUMENTS																	
		Document Number							Date	Country	Class	Subclass	Translation				
													Yes	No			
Other Documents (including Author, Title, Date, Pertinent Pages, Etc.)																	
		Matsubara et al., "Pressure Wave Generator for a Pulse Tube Cooler", Cryocoolers 12 (2003) pp 343-349															
Examiner									Date Considered								
* EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.																	